he passed away, to witness the son installed in the chair vacated by himself only a few years previously.

The great task of his life completed in 1910, Suess's closing years have been happy and restful, for only quite recently came the bronchial affection which terminated his life in his eighty-fourth year.

Suess held much the same position among German-speaking peoples as did Huxley among English and Americans. They both held that, in addition to their scientific labours, however exacting these might be, something in the way of service was due to the cities in which they lived and the states to which they belonged. In 1862 Suess had directed attention to the unsatisfactory condition of the water-supply of Vienna, and, from 1863 to 1873, he was called upon to serve as a member of the Municipal Council of Vienna; it was due to his initiative in this capacity that an aqueduct, 110 kilometres long, was built to bring water from the Alps to the city, and that other great improvements in the sanitary conditions of Vienna were undertaken. For more than thirty years he was a member of the Lower House of the Reichsrath, and proved himself a doughty champion against the defenders of political privileges and of clericalism. Like Huxley, he declined many offers of honours and titles from the State, but was amply compensated by the marks of esteem from his fellow-workers in science. He was president of the Austrian Academy of Sciences, a member of the French Institute, Foreign Member of the Royal Society since 1894, and member of scientific societies in every part of the world. He received the Wollaston medal of the Geological Society in 1896, and the Copley medal of the Royal Society in 1903.

John W. Judd.

ROBERT KAYE GRAY.

It is with deep regret that we have to record the death of Mr. Robert Kaye Gray, who passed away on April 28, at Brighton, after a long illness, at the age of sixty-two. He was well known as the managing director of the India-Rubber, Gutta-Percha, and Telegraph Works Co. at Silvertown, but his interests extended far beyond the range of commerce, and he became associated with many institutions and societies for the improvement of natural knowledge, and for the welfare of the sick and needy. His attractive personality, his quiet way of doing good, his unbounded generosity, the breadth of his mind, and his exceptional store of worldly wisdom, made him the centre of a multiplicity of activities; and there is no doubt that in recent years the constant demand made upon his powers and judgment hastened the end of his remarkable career.

Readers of Nature will recall how large a share Mr. Gray took in establishing and supporting the National Physical Laboratory. He had the satisfaction of seeing the laboratory extend in scope and usefulness, and his name will always be associated with that of the late Sir William White in the pioneer work of giving direction to its latent possibilities. His loss will be keenly felt by the Institution of Electrical Engineers, of which he was a past president, by the Royal Society of Arts, and the Institute of Metals, to which he rendered substantial help.

The cause of technical and university education in London has also suffered by the loss of Mr. Robert Gray, who gave freely of his time and from the fund of his experience to aid in their advance. His association with submarine telegraphy brought him into touch with engineers and others in every quarter of the globe, and it is not too much to say that he was universally esteemed and honoured.

From his father, the late Matthew Gray, an engineer of high ideals and remarkable strength of character, Mr. Gray inherited a mind intent upon accomplishing large things by straight means. Early in his professional life he set himself to master every branch of submarine telegraph engineering, including the manufacture, laying, and testing of cables. This knowledge and experience was the basis of his subsequent professional work, and it led him ultimately towards that field of natural science of a practical kind, which afforded him full scope for his energies. In the history of the progress of the age through which he passed he must be assigned a place as a representative man, and as a man of affairs. He was representative of the age in which commerce became a science, and science a refining influence —the age in which science was at last seen to be consistent with benevolence.

NOTES.

America has lost one of her foremost astronomers by the death, in his seventy-seventh year, of Dr. George William Hill. He graduated at Rutgers College in 1859, and in 1861 became an assistant in the office of the American Ephemeris and Nautical Almanack. He afterwards became chief of this publication. From 1898 to 1901 he was lecturer in celestial mechanics at Columbia University, New York. In 1887 the Royal Astronomical Society awarded him its gold medal for his researches in connection with the lunar theory. He was a foreign member of that society, and also of the Royal Society, and a corresponding member of the Institute of France. In 1892 Cambridge University conferred on him its honorary Sc.D. He was president of the American Mathematical Society from 1894 to 1896. In 1905 the Carnegie Institution published a volume of his collected mathematical works, with an introduction by Henri Poincaré. Dr. Hill was also the author of a work on "The Theory of Jupiter and Saturn."

Mr. C. S. S. Peirce, an American mathematician and logician of international reputation, has died at the age of seventy-four. He was a son of Prof. Benjamin Peirce, of Harvard, and was himself educated at that University. For a few years he was a teacher of logic in Johns Hopkins University, and he gave occasional lectures at Harvard, but the greater part of his life was devoted to study and research. Since 1887 he had lived in seclusion in a little cabin in the mountains near Milford, Pennsylvania, where he had collected what is believed to be one of the most complete private reference libraries in the world on the subjects in which he was interested. He edited several of his father's mathematical works, and was the author of "Photometric Researches," as well as of numerous papers on logic, the history of science, psychology, astronomy, optics, colour sense, map projections, chemistry, engineering, early English pronunciation, library cataloguing, etc. Mr. Peirce was one of the pioneers of symbolic logic, and was the first to formulate the philosophical principle which he named "pragmatism." He dissented, however, from Prof. William James's development of this principle.

We regret to record the death, in Paris, of M. Wilfred de Fonvielle. Few men have done more to popularise the subject of aeronautics than M. de Fonvielle, who not only wrote numerous books and articles, both popular and scientific, upon the subject, but also did much practical work, especially in regard to balloons. Commencing life as a journalist, he joined the staff of a journal, *La Presse Scientifique*, edited by M. Barral. The latter had just been making his well-known balloon ascents for scientific observation, which greatly interested the young enthusiast and started him writing articles on the subject. Since then, until recently, his pen had but little rest. His principal works are:—"La Science en Ballon" (1869); "Voyages Aériens" (with Glaisher and others) (1871), translated into English; "Les Ballons pendant le Siège" (1871); "Traité Pratique de Navigation Aérienne" (1872); "Aventures Aérienne" (1876), translated into English; "La Conquête de l'Air" (1882); "Notre Flotte Aérienne" (1908); and a vast number of articles in French and English papers and magazines, including many contributions to our columns. De Fonvielle's first balloon ascent was made in the great *Géant*, with M. Nadar, in 1867. Numerous other journeys followed, until he became considered one of the leading aeronauts in France. During the siege of Paris he piloted one of the balloons which left that city, descending in Belgium, whence he crossed to England. In later years he paid frequent visits to this country, where he several times made balloon ascents. For some years he was president of the Société Française de Navigation Aérienne.

Botanists will learn with regret of the death, at seventy-five years of age, of M. van Tieghem, member of the Institute of France, professor at the Natural History Museum, Paris, and one of the most eminent of modern workers in the field of botany. As a young man he worked under Pasteur, and he made valuable contributions to science in the domain of bacteriology. In 1873 he published, in conjunction with his pupil, G. Le Monnier, a monograph on the Mucorineæ, in which the morphology and physiology of the family were carefully studied, and a detailed systematic account was given for the first time. Two further contributions on the same subject appeared in 1875 and 1876. But van Tieghem is best known for his work on the anatomy and morphology of the seed-plants. In 1866 appeared an important paper on the anatomical structure of the Aroideæ, and his concluding remarks supply the key to his work in this field. He says:—"Nos observations semblent démontrer aussi par une preuve nouvelle qu'il est indispensable de joindre l'étude anatomique comparée de l'appareil végétatif à celle de la fleur, si l'on veut construire le système idéel à liaisons fixes qui est l'objet de la méthode naturelle." The systems of classification which he proposed were, however, the least valuable part of his work; they indicated lack of appreciation of the relative value of characters, and were hampered by a cumbersome terminology. On the other hand, his work on the comparative anatomy of the female flower and fruit of the Gymnosperms was of fundamental value. In 1882 he succeeded Decaisne as botanical editor of the *Annales des Sciences Naturelles*, a post which he held until his death, and the long series of memoirs in this journal by himself and his pupils on the morphology and anatomy of various families and genera of seed-plants will form a permanent monument of his industry and botanical work.

The Bruce medal of the Astronomical Society of the Pacific has been awarded to Dr. O. Backlund, director of the Pulkowa Observatory.

Science announces the retirement, on July 1, after twenty-one years' connection with the Yerkes Observatory, of Prof. S. W. Burnham.

The Wellcome Historical Medical Museum is to be reopened on May 28, at 54*a* Wigmore Street, as a permanent institution in London. Since the closing of the museum in October last the collections have been much augmented and entirely rearranged.

It is announced in *Science* that the amount subscribed in connection with the jubilee celebration of Dr. A. Auwers has been handed to the Berlin Academy for the foundation of a prize (to be known as the Bradley Prize) to be awarded once every five years.

According to the *Lancet*, it has been decided by the Liverpool School of Tropical Medicine to establish a permanent laboratory in Sierra Leone for the purpose of carrying on research work. It is hoped that the laboratory will act as a base from which expeditions to other regions of tropical Africa may be dispatched from time to time.

An International Conference of Telegraph Engineers is to be held in Berne from September 14 to 20 next. Among the subjects open for discussion are the prospects of telephony over longer distances, the protection of telegraph and telephone wires from other electrical conductors, and how far automatic apparatus in telephone exchange working is desirable.

The summer meeting of the Institution of Naval Architects will be held in Newcastle-on-Tyne on July 7–10, at the invitation of the institution by the president and council of the North-East Coast Institution of Engineers and Shipbuilders. Meetings for the reading of papers will be held, and arrangements will be made to visit some of the principal works in Newcastle and its vicinity.

In order to commemorate the work of Wilbur Wright, who, with his brother, Orville Wright, evolved the first successful power-driven aeroplane, the Wilbur Wright Memorial Fund was created under the auspices of the Aeronautical Society for the purpose of providing for the annual delivery of a premium lecture. The second memorial lecture will be delivered by Dr. R. T. Glazebrook, director of the National Physical Laboratory, on May 20, at the Royal United Service Institution, Whitehall, S.W. The Right Hon. Lord Sydenham will preside.

Mr. A. N. Hall has been appointed Government curator of the Ancient Monuments of Rhodesia. According to the *Geographical Journal*, the objects under his charge will include not only ruins, but all relics wherever found, and also the Bushman paintings, all of which are in future to be protected from vandalism and preventible destruction. The headquarters of the curator will be at Great Zimbabwe, but Mr. Hall hopes, it is stated, to spend four months of each year in examining or searching for other remains.

The Board of Agriculture and Fisheries desires to bring to the attention of the public the arrangement now established at the Royal Botanic Gardens, Kew, whereby a competent guide accompanies visitors on weekdays through the gardens and explains the many objects of botanical interest. A small charge is made for the services of the guide, 6*d.* for each person attending a morning tour, and 3*d.* for each person attending an afternoon tour. The present arrangements are of the nature of an experiment, and their continuance beyond September next will depend on the extent of the public demand for the services of the guide. A leaflet giving detailed information on the subject can be obtained on application to the director, Royal Botanic Gardens, Kew.

The thirteenth annual general meeting of the Marine Biological Association of the United Kingdom was held in the rooms of the Royal Society on April 29, Sir E. Ray Lankester, president of the association, being in the chair. Dr. P. Chalmers Mitchell and Mr. F. A. Potts were elected to fill two vacancies on the council. In the annual report reference was made to the discovery at Plymouth of the puerulus stage of the sea crayfish (Palinurus) by Prof. Bouvier, of Paris, to the investigations on eggs and young stages of British food fishes, by Mr. R. S. Clark, on the feeding habits and rate of growth of invertebrates, by Mr. J. H. Orton, and on the culture of plankton diatoms, by Dr. E. J. Allen. Mention was also made of work carried out at the laboratory by Mrs. Matthews on the development of Alcyonium, by Dr. Mortensen on the larvæ of Echinoderms, by Dr. Shearer, Mr. De Morgan, and Mr. Fuchs on the hybridisation of Echinoderms, by Mr. J. Gray on the electrical conductivity of Echinus eggs, and by Dr. Stuart Thomson on the brain of Elasmobranchs. It was reported that Mr. D. J. Matthews and Mr. L. R. Crawshay had returned to the laboratory from the expedition of the *Scotia* to the coast of Labrador, and Mr. E. W. Nelson from the British Antarctic Expedition, and that these gentlemen had been employed in working up the material which they had obtained.

At Greenwich the mean temperature for the month of April was 50·8°, which is 2·7° above the average. This is the warmest April for the last ten years, but there have been six warmer Aprils since 1841, the warmest being 53·9° in 1865. The mean of the maximum temperatures was 61·1°, and the mean of the minimum 40·5°. There were three days with a temperature of 70° or above; in 1865 there were fourteen days above 70°. The total rainfall was 1·12 in., of which 1·10 in. was measured during the first ten days and only 0·02 in. at Greenwich in the remainder of the month. The duration of sunshine at Greenwich was 231·6 hours, which is 166 per cent. of the average. It is the sunniest month at any time of the year since the memorable summer of 1911, and has only once been surpassed previously in April at Greenwich, 1909 having 250 hours of bright sunshine. There were thirteen days with more than ten hours of sunshine, and April 30 was the only day during the month on which the sun did not shine.

In the recent annual report of the Decimal Association there is a reference to the legalisation of the metric carat in this country. Although the Order in Council came into operation so recently as April 1, it is satisfactory to note that the adoption of the new unit by dealers in diamonds and precious stones is already practically complete, and has occasioned little or no inconvenience. The manufacturers of weights in this country do not appear to have realised that the change would be effected so readily, and in consequence of this a large proportion of the sets of metric carat weights have been imported from the Continent to meet the sudden demand. The largest metric carat weight legalised is the 500 C.M., which is equivalent to 100 grams. Many diamond dealers who have been accustomed to use weights up to 5000 carats were inclined at first to imagine that such large single weights would not be permissible in future, but they now understand that above 500 C.M. the ordinary metric series, 200 grams, 500 grams, kilogram, etc., may be employed, and little difficulty is experienced by them in adapting their operations to the new conditions.

The Peabody Museum of American Archæology and Ethnology, Harvard University, publishes a fine monograph by Mr. A. M. Tozzer on the prehistoric ruins of Nakum, in Guatemala. The museum expeditions since 1888 have been engaged in exploring the Maya area in Mexico, Guatemala, Honduras, and British Honduras. Unfortunately, these interesting ruins have suffered much from fires lighted by natives to clear the ground for cultivation, and from sheer vandalism. Quite recently some of the sculptured stelæ at Copan were destroyed to make the foundations for an adobe wall. Several ruined cities have been discovered, and it is well that the surveys now in progress should be undertaken while the material remains undisturbed.

The *Times* of April 25 publishes a preliminary report on the excavations at the Great Stone Circle at Avebury. The work has extended to the silting of the fosse on the east side, and against the solid chalk entrance causeway on the south of the great circle. A few antler picks and hammers and a finely worked flint implement have already been found in the chalk rubble, and in the Roman stratum nearer the surface a ring and part of a bracelet, both of bronze. In the cutting of the vallum have been decovered two red deer antlers and an interesting bone pin nicely worked and polished. The old surface line has been reached in places, and is clearly defined; on it have been found several small fragments of prehistoric pottery, a flint scraper, and two flint saws, as well as clear traces of charcoal.

According to the April number of the *Museums Journal*, the chief loan collections at the twenty-fifth conference of the Museum Association, to be held at Swansea in July, will comprise Welsh pottery and porcelain, paintings by old masters and modern Rouen artists, Rouen decorative metal-work, and old Welsh furniture and lacquer.

Among questions discussed in Publication No. 2169 (Opinions 52–56) of the International Commission on Zoological Nomenclature is the validity of the names, which were edited by Linnæus, in Hasselquist's "Iter Palæstinum"—published prior to 1757. It is ruled that these are invalid, despite the publication of a German translation of the volume in 1757, which, it had been urged, might justify their recognition.

The surface-swimming copepod crustaceans of the Gulf of Manaar form the subject of the longest article, by Capt. R. B. S. Sewell, in No. 35 (vol. ix.) of *Spolia Zeylanica*. The account is mainly based on two collections—one made between 1906 and 1909 inclusive, and the other in 1913; these embrace a total of eighty-seven species and subspecies, of which five are described as new. This number also includes the second part of a paper by Dr. J. Pearson on the holothurians of the Indian Ocean, together with a revision, by the same writer, of the genera Muelleria and Holothuria.

In the introduction to a long reply on certain criticisms of the theory of mimicry, the greater portion of which appears in the January issue of the Proceedings of the Academy of Philadelphia, Prof. Poulton remarks that more definite evidence than we at present possess with regard to the butterfly-eating habit in birds, and that some species of butterflies are nauseous to them, is urgently required. Such evidence is, however, steadily increasing, an important item coming from Uganda, where a wagtail, after eating butterflies belonging to two groups, rejected one representing a third.

"Elvers," writes Mr. J. S. Elliott in an article on eels and eel-catching in Bedfordshire in the April number of the *Zoologist*, ascend the Ouse and its tributaries in swarms from the Wash. From the time of Domesday Book most Bedfordshire mills have been provided with eel-traps, which in early days furnished a considerable instalment of the rent. Although apparently less than formerly, the total average catch in the county is now about 3 tons 18 cwt., representing something like 17,500 eels, with a value, at the local price of 6*d.* a pound, of practically 220*l.*

To the March number of *Naturen* Mr. Ørjan Olsen contributes an illustrated account of the whales of South Africa, and whaling as carried on at Durban and Saldanha Bay on the east, and at Port Alexandre, Benguela, on the west coast. A considerale amount of space is devoted to *Balaenoptera brydei*, the new rorqual described by Mr. Olsen last year, of which 169 individuals were taken in 1912. In the following year, up to July, 92 common fin-whales and 36 blue whales were captured at the Saldanha Bay station. The other species taken were the southern humpback (*Megaptera boöps*, or *nodosa, lalandei*), the southern right whale (*Balaena australis*), which is very rare, and the sperm-whale.

Photographs of two recently added animal groups appear in the report of the American Museum of Natural History, one representing the reptile life of the Californian cactus-desert tract, and the other showing portions of two piles grown over with mussels and sea-anemones from a group illustrating the fauna of submerged timber. An item in the report well worthy the attention of museum curators in this country is a photograph of fireproof cases recently installed for the storage of mammal skins. If this is worth doing in America, it is still more so in our our own Natural History Museum, with its priceless series of "type" specimens. Even if the new method of storage could not be applied to the whole study-collection, it might be employed for types.

Dr. Enrico Festa has utilised the opportunity presented by the Italian occupation of Rhodes to visit the island for the purpose of studying its fauna. An account of his observations, and reports on his collections have recently been published (*Bolletino dei Musei di Zoologia ed Anat. comp. della R. Università di Torino*, vols. xxviii.–xxix). Most of the animals recorded belong to species already known from other parts of the Mediterranean region, but a few are new or of special interest. A hundred and thirteen species of birds were obtained, including a new species of jay (Garrulus) and a new species of redbreast (Erithacus). There are two new earthworms (Helodrilus), two new woodlice (Armadillidium), three new locustids, one of which is referred to a new genus, and a new variety of the river crab (*Potamon edule*) of southern Europe. The other groups reported upon are the hymenoptera, fleas, earwigs, scorpions, and the mosses and liverworts (these last in *Annali di Botanica*, vol. xii.).

An account of work on the control of damping-off disease in plant beds has been recently published in bulletin form (No. 31, University of Wisconsin Agricultural Experiment Station). According to the observations of the author, Mr. James Johnson, the two most common fungi giving rise to the disease are Pythium de Baryianum and Rhizoctonia, and these have been found on seedlings of a large number of different plants, including cress, tobacco, lettuce, tomato, etc. The effect of various cultural conditions, such as moisture, temperature, aeration on the growth and spread of the disease, is discussed, and the results of experiments as to preventive measures are given.

Treatment of infected soils with formalin 1 : 50 has been found efficient in checking the disease, but from the point of cheapness and efficiency steam-heating is recommended. Certain secondary effects, such as the killing of weed seeds and the destruction of insect pests in the soil, and greatly increased size and vigour of plants grown in treated soils, were also noted.

IN a recent Bulletin of the U.S. Weather Bureau the Rev. M. Saderra Masó describes an interesting series of earthquakes which occurred in the sub-province of Benguet (Luzon) in August and September, 1913. They were very numerous (about 350 occurring in little more than a month), as a rule of slight intensity, and, even with the strongest, of very small disturbed area. It is probable that they originated at a very slight depth. As the earthquakes occurred at the close of the rainy season, in a limestone district in which the annual rainfall is about 160 inches, and in which there are frequent subsidences of the ground, the author concludes that the earthquakes are neither tectonic nor volcanic in their origin, but probably due to underground rock-falls and secondary faults.

THE Meteorological Office of Canada has recently issued an interesting monograph, "Canadian Weather Forecasting," as an addendum to "Gales from the Great Lakes to the Maritime Provinces," covering the years 1905–12, prepared by Mr. B. C. Webber, under the superintendence of the director of the Meteorological Service. In a preceding monograph for the period 1874–1904 Mr. Webber suggested some aids to assist the forecast officials, and these have now been supplemented, and the tables show, in addition, the percentages of low-pressure areas causing storms in various months and districts and the directions in which the depressions moved, together with other useful information. November is the most stormy month on the Great Lakes during the season of navigation, but January and February are the stormiest in the Gulf of St. Lawrence and the Maritime Provinces; March is not an unusually stormy month. Within the eight years in question the area of the Canadian weather map has been much enlarged, and knowledge of movements of high- and low-pressure areas has been enhanced by the introduction of a daily meteorological chart of the northern hemisphere since January 1, 1912. It is, however, reluctantly admitted that the advancement of weather forecasting has been more or less disappointing. The author considers that the study of the upper air and of solar physics will eventually undoubtedly assist in solving some of the vexed problems which confront the meteorologist.

THE necessity of bringing modern mathematical concepts within the range of study of comparatively elementary students has led Mr. C. Elliott, of King Edward VII. School, Sheffield, to produce a book of 116 pages, entitled "Models to Illustrate the Foundations of Mathematics" (Edinburgh: Lindsay and Co., 1914, price 2*s*. 6*d*.). It consists of four chapters dealing respectively with the meaning of correspondences, multiplexes, spaces defined as ordered multiplexes, correspondence of operands to functions, and multiple correspondence. Although a selection of classificatory models was exhibited at the 1912 Mathematical Congress, the use of the term "models" in the title of this book may perhaps be rather misleading, for it consists mainly of definitions and explanations, and the nearest approach to models generally consists in mere references to illustrations of classes, like and unlike things, correspondences, and so forth, where these can be exemplified by objects of everyday life. The question as to how far the subject can be understood and appreciated by schoolboys is a very interesting one.

THE first of a series of illustrated articles descriptive of a 300,000-h.p. hydro-electric plant on the Mississippi appears in the *Engineer* for May 1. These works are situated at Keokuk, on the Iowa side of the river, about 130 miles north of the mouth of the Missouri River, and 137 miles from the city of St. Louis. One purpose of the power development is to deliver current in large quantities to distant points by transmission lines up to 200 miles in length, and in August last the supply of current to St. Louis was commenced. The electric light and tramway company of St. Louis has contracted to take 60,000 h.p. for a term of ninety-nine years. The works comprise three main sections. First, a dam 4700 ft. long, extending from the east bank at Hamilton to within a thousand feet of the west bank at Keokuk. Secondly, a power-house, extending downstream from the end of the dam for a length of 1700 ft. Thirdly, a dam extending from the lower end of the power-house to the west bank, forming the fore-bay and having a large single-lift lock for navigation. The total length of monolithic concrete construction is more than two miles. The working head of water available for the machines ranges from 23 to 40 ft.

OUR ASTRONOMICAL COLUMN.

MAY METEORS.—It is hoped that favourable conditions will be experienced for the observation of Coronid meteors in May. Mr. W. F. Denning directs attention to this shower in *Astronomische Nachrichten*, No. 4726. In recent years he found the chief radiant point to be about 246°+30° near ζ Coronæ, and a few degrees west of ρ Herculis. According to his observations in 1903 and 1911, the meteors were white, swift, and usually trainless. The most suitable time for their observation is between May 18 and 26, and the absence of the moon will render the observation more easy.

COMET 1914*a* (KRITZINGER).—The following is the continuation of the ephemeris of comet 1914*a* (Kritzinger) which was given in this column last week, the information being gathered from Prof. H. Kobold's communication to the *Astronomische Nachrichten*, No. 4729:—

12*h*. *M.T.* *Berlin*.

	R.A. (true)			Dec. (true)		Mag.
	h.	m.	s.	°		
May 7	18	46	9	+23	29·0	
8		50	57	24	25·9	8·5
9		55	45	25	21·9	
10	19	0	34	26	16·7	
11		5	24	27	10·4	
12		10	14	28	2·8	8·4
13		15	4	28	53·9	
14	19	19	54	+29	43·6	